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(54) PELLETED SEEDS

(71) We, SAREA A.G., a Swiss Body Corporate, of Poststrasse 14, Zug (Switzerland), do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

Plant seeds have been pelleted, i.e. given solid coatings, in order to associate various useful substances, e.g. fungicides and insecticides, with the seeds. In Austrian Patent Specification No. 271,089 pelleted seeds are described in which the coating has a number of layers, a layer near the seed comprising a fungicide and an outer layer comprising an insecticide. By use of such coatings it is possible to include active substances which are incompatible when mixed together, e.g. certain fungicides and insecticides, and such coatings also permit the use of active substances which should not be too near the seed itself. In addition to the layers comprising active substances the coatings have one or more intermediate layers of neutral materials e.g. fibrous cellulosic matter or amorphous mineral matter.

It has been found that pelleted seeds of the above type are not generally satisfactory since the proposed coatings are rather hard and can severely inhibit appearance of the shoots of the pelleted seeds after sowing. This disadvantage can admittedly be reduced by making the layers of the coatings softer but this is not a satisfactory solution since the seed pellets are then more subject to breaking and abrasion damage and this is a disadvantage particularly in the sowing operation. In pelleted seeds the use of a layer of material which softens or swells on absorption of water has been proposed but the coating may still severely impede satisfactory germination since the softening or swelling tends to occur rather slowly.

We have now found that the disadvantages mentioned above can be avoided by having a layer comprising a disintegrating agent in the coating of multi-layer pelleted seeds. According to the present invention pelleted seeds have a coating comprising an inner layer comprising a fungicide, a distinct outer layer comprising an insecticide, a layer comprising neutral pelleting material and a layer comprising a disintegrating agent.

In the pelleted seeds according to the invention the layer comprising a fungicide is distinct from that comprising an insecticide and these layers are respectively inner and outer in the sense that the former is nearer the seed. A wide variety of fungicides may be used, many fungicides being known for use with seeds. Examples of suitable fungicides are seed grain disinfectants e.g. Ceresan dry disinfectant, a mercury-based preparation, synthetic fungicides such as dithiocarbamates e.g. Zineb and Maneb, copper-based fungicides e.g. Linz green copper and combined seed grain preservatives e.g. Thiravit D. ("Ceresan" is a Trade Mark.) Similarly a wide range of insecticides are usable. Examples include insecticides of the chlorinated hydrocarbon type e.g. Heptachlor, combined insecticide preparations e.g. Ardap D and other non-systemic insecticides. Insecticides with a partially or chiefly systemic action e.g. Theimet are also usable.

The coatings have at least one layer comprising a disintegrating agent but this layer may be one also containing other matter e.g. neutral pelleting material. The disintegrating agents which can be used are stable in the pelleted seeds before sowing but are unstable once the seeds are sown and are such as to cause disintegration i.e. breaking up of the coating once the seeds are sown. The use of the disintegrating agent thus enables the advantages of multi-layer pelleted seeds to be retained whilst avoiding disadvantages of known pelleted seeds of this type e.g. the disadvantage of inhibited germination.

A variety of disintegrating agents can be used, the essential characteristic being that whilst being normally stable they undergo decomposition in the conditions prevailing in soil or other cultivation media to exert a disintegrating action on the coating. Various

influences or combinations of influences may be responsible for the effect of the disintegrating agents when the pelleted seeds are sown: thus the presence of water, acids and oxygen in the soil or other cultivation medium may all play a part in rendering the agents effective. It is greatly preferred that the disintegrating agents should be such as to cause evolution of gases and thereby cause disintegration when the seeds are sown. Examples of suitable disintegrating agents are carbonates, bicarbonates, chromates, bromates and perchlorates, in particular the alkali metal salts e.g. the sodium and potassium salts. Particularly preferred disintegrating agents are sodium carbonate and bicarbonate and potassium bromate and chromate.

The effect of the disintegrating agents is wholly different from that of swelling agents. Swelling agents in the presence of water merely cause slow and gradual softening of the coatings whereas the disintegrating agents are much more rapid in effect and produce a different effect namely cracking of the coating. The effect of the disintegrating agents is thus to permit ready germination of the seeds which is inhibited in pelleted seeds lacking a disintegrating agent. Because of the relatively rapid disintegration which can be achieved, the layers of the coating can be quite hard. This is advantageous since it means that breaking or abrasion of the pellets can be minimised and consequential difficulties in the sowing operation thereby minimised. The advantages of the coatings are particularly marked in the case of small seeds since in this case a relatively thick coating is generally desirable but thick coatings of the known types have had the drawback of inhibiting satisfactory germination particularly seriously.

The coatings of pelleted seeds in accordance with the invention may include swelling agents in addition to disintegrating agents. Swelling agents may be used which are of natural origin such as vegetable hydrocolloids, e.g. carob bean flour, guar flour, tragacanth flour and gum arabic, alginates, e.g. ones derived from algae and Icelandic moss, balsa wood flour and animal hair. Chemically modified natural substances may also be used as swelling agents. Examples of substances of this type are methylated cellulose e.g. carboxymethyl cellulose, starch glycollates, sodium amylopectin glycollates such as ultraamylopectin and addition products of ethylene oxide with cellulose such as "Ethoxose". Entirely synthetic swelling agents may be used. These may be, for example, foamed vinyl- or acrylate-based polymers. Examples of suitable synthetic swelling agents include polyvinyl alcohol, polyvinyl ether and sodium polyacrylates and polymethacrylates. If a swelling agent is used it will normally be present in the same layer as the disintegrating agent.

In the seed pellets various further materials may be included in the coatings for specific purposes. Thus the coatings may contain fertilisers, growth-promoting substances, hormones, colourants and glaze-producing agents preferably any fertiliser, growth-promoting substance or hormone is in the same layer as the disintegrating agent. The coatings may be built up by means conventional in the production of multi-layer pelleted seeds. Thus the seed itself can initially be dusted with whatever matter is to be present in the innermost layer of the coating and a binder then sprayed on. Suitable binders for spraying are solutions of sugars, gum arabic or starch. Further layers of the coatings can be provided similarly.

The layer comprising the disintegrating agent may be in any position in the coating in relation to the seed but it is often particularly satisfactory if this layer is the innermost layer or is at least inner with respect to the layer comprising the insecticide. The layer comprising the insecticide is normally the outermost layer with the possible exception of any final glaze which may be applied.

The following are examples of ways in which the layers may be arranged.

Example 1.

In this case a layer comprising a disintegrating agent is in contact with the seed itself, the next layer is one comprising a fungicide, the next layer is of a neutral pelleting material and the outermost layer comprises both an insecticide and a glaze.

Example 2.

In this case a layer comprising a fungicide is in contact with the seed itself, the next layer comprises a disintegrating agent, the next layer is of a neutral pelleting material and the outermost layer comprises both an insecticide and a glaze.

Example 3.

In this case a layer comprising a fungicide is again in contact with the seed itself, the next layer is of a neutral pelleting material, the next layer comprises a disintegrating agent and the outermost layer comprises both an insecticide and a glaze.

In each of the above examples the layer comprising the disintegrating agent may also comprise a swelling agent.

It can be particularly advantageous for certain of the desired components of the coatings to be combined together in a smaller number of layers. The following is an example of this.

Example 4.

In this case a simplified but very effective coating structure is achieved by having a layer, in contact with the seed itself, comprising a fungicide, a disintegrating agent and

neutral pelleting material and, as the only other layer, an outer layer comprising an insecticide and a glaze. The inner layer may also comprise a swelling agent.

If the disintegrating agent is one which is very easily activated it may be advantageous to sandwich a layer comprising the disintegrating agent between two layers of neutral pelleting material. The following is an example of this.

Example 5.

In this case a layer comprising neutral pelleting material is in contact with the seed itself, the next layer comprises a fungicide, this layer being overlaid by a further layer comprising neutral pelleting material, the next layer comprises a disintegrating agent and is overlaid by a third layer comprising neutral pelleting material, the next layer comprises an insecticide and the outermost layer is a glaze. A swelling agent may be present in the layer comprising the disintegrating agent.

The following example compares the germination of non-pelleted seeds with that of both conventional pelleted seeds and pelleted seeds in accordance with the invention.

Example 6.

Sugar beet seeds were subjected to laboratory germination tests. Some of the seeds were not pelleted, some were pelleted in accordance with the invention, and some were pelleted in accordance with Austrian Patent Specification No. 271,089. In these tests the seeds were in filter pouches, modified in accordance with the Neeb method. The results are shown in the following Table.

Test No.	Test material	Germination capacity after 7 days	Germination capacity after 14 days
1	Seed, non-pelleted	85.6%	86.1%
2	Seed pellet without disintegrating agent	88.8%	91.1%
3	Pellet with disintegrating agent according to the invention	92.5%	94.9%

As can be seen from the above Table, the germination capacity of the sugar beet seeds increased markedly as a result of the conventional pelleting and was increased considerably further by the addition of the disintegrating agent.

The seeds were also tested in the field under normal cultivation methods and conditions on an experimental farm. The results are shown in the following Table.

Test No.	Test Material	Sprouting in %
1	Seed, non-pelleted	54.5%
2	Seed pellet without disintegrating agent	55.3%
3	Pellet with disintegrating agent according to the invention	61.8%

As can be seen from the above Table a significant improvement in sprouting in the field is obtained with the seed pellets made up in accordance with the invention. With the increase in sprouting in the field there are obtained both a more rapid growth and an increase in the plant stock per hectare, while retaining the same sowing quantities. Simultaneously, a better distribution of the plant stock per hectare is also produced. Finally, through the increase in sprouting in the field, the assurance of an optimum plant stock can also be obtained with greater probability.

WHAT WE CLAIM IS:—

1. Pelleted seeds in which the seeds have a coating comprising an inner layer comprising a fungicide, a distinct outer layer comprising an insecticide, a layer comprising neutral pelleting material and a layer comprising a disintegrating agent.

2. Pelleted seeds according to claim 1 in which the disintegrating agent is in a layer separate from the other layers.

3. Pelleted seeds according to claim 1 in which the disintegrating agent is in a layer also comprising neutral pelleting material.

4. Pelleted seeds according to any preceding claim in which the coating contains a fertiliser, liser, growth-promoting substance, hormone, colourant or glaze-producing agent.

5. Pelleted seeds according to claim 4 in which a fertiliser, growth-promoting substance or hormone is present in the same layer as the disintegrating agent.

6. Pelleted seeds according to any preceding claim in which the disintegrating agent is a carbonate, bicarbonate, bromate or perchlorate.

7. Pelleted seeds according to any preceding claim in which the disintegrating agent is in the innermost layer.

8. Pelleted seeds according to any preceding claim in which the coating comprises a swelling agent.

9. Pelleted seeds according to claim 8 in which the swelling agent is present in the same layer as the disintegrating agent.

10. Pelleted seeds according to claim 8 or claim 9 in which the swelling agent is a vegetable or animal swelling agent.

11. Pelleted seeds according to claim 8 or claim 9 in which the swelling agent is a methyl cellulose, a starch glycollate, a sodium amylopectin glycollate or an ethylene oxide addition product.

12. Pelleted seeds according to claim 8 or claim 9 in which the swelling agent is a polyvinyl compound, a polyacrylate or a polymethacrylate.

13. Pelleted seeds according to claim 1 substantially as hereinbefore described with reference to any of the Examples.

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